The Dark Side of the Force: A Geometric Lattice Model for Neutrino Sector Splitting and Dark-Sector Anisotropy

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We present a geometric toy model built from a three-node SU(3)-like root lattice, a five-dimensional Randers/Finsler phase space, and an internal T^{17} compactification. A holon displacement generates an 8/9 (dark/on-plane) versus 1/9 (electromagnetic/off-plane) split in the neutrino sector. The Randers one-form β encodes the off-plane tilt, the preferred time direction associated with C_2, and the anisotropy toward Sgr A*. The norm $\|\beta\|$ controls dark-sector masses, mixing, and weak-equivalence-principle violation. A chiral operator G_{C_3} produces topological defects labeled by an integer winding number $v \in \mathbb{Z}$, interpreted as a discrete "integer time" (*vez*). The framework yields testable signatures in neutrino observables, anisotropy searches, and dark-sector phenomenology.

I. INTRODUCTION

We explore a geometric construction in which neutrino-sector structure, dark-sector dynamics, and anisotropy arise from a common underlying framework. The model combines:

- a three-node SU(3)-like lattice with time-like directions C_1, C_2, C_3,
- a holon displacement generating an 8/9 vs. 1/9 split,
- a five-dimensional Randers/Finsler phase space with $F = \alpha + \beta$,
- an internal T^{17} compactification.

The one-form β is the directional engine of the model, encoding the holon tilt and the preferred forward direction toward Sgr A*.

II. THREE-NODE LATTICE AND NEUTRINO SPLIT

A. Time nodes

We define three Cartan-like time directions:

$$C_1 = (2, -1, -1), \tag{1}$$
$$C_2 = (-1, 2, -1), \tag{2}$$
$$C_3 = (-1, -1, 2), \tag{3}$$

with C_2 the preferred forward direction.

B. Leptons as roots

Charged leptons correspond to positive roots:

$$e^- = (1, -1, 0), \tag{4}$$
$$\mu^- = (0, 1, -1), \tag{5}$$
$$\tau^- = (-1, 0, 1), \tag{6}$$

and neutrinos to the negative roots.

C. Holon displacement and the 8/9 vs. 1/9 split

A neutrino-sector weight

$$L_\nu = (-4, 4, 0)$$

has on-plane magnitude 8. A holon displacement ± 1 produces a total weight 9, yielding:

$$\frac{8}{9} \text{ (dark/on-plane)}, \qquad \frac{1}{9} \text{ (EM/off-plane)}.$$

III. RANDERS GEOMETRY AND THE ONE-FORM β

A. Randers structure

The five-dimensional phase space carries a Randers/Finsler structure:

$$F = \alpha + \beta,$$

with $\alpha = G_{C_3}$ the symmetric core and β the anisotropic one-form.

B. Explicit form of the one-form

In projected coordinates (x, y, z) on the 3×3 square:

$$\beta = \beta_0 \sin(10^\circ) \frac{1}{9} \frac{1}{v} (dx^2 - dy^2),$$

where:

- β_0 is the fundamental geometric scale (cube scale),
- $\sin(10^\circ)$ is the holon tilt,
- $1/9$ is the holon projection,
- $1/v$ encodes winding suppression,
- $v \in \mathbb{Z}$ labels the topological sector.

C. Norm and physical couplings

The physically relevant quantity is the norm:

$$\|\beta\| = \sqrt{g^{\mu\nu} b_\mu b_\nu}.$$

We parametrize dark-sector observables as:

$$m_{\tau_d} = g_\beta \, \|\beta\|, \tag{7}$$
$$m_{\gamma_d} = c_\gamma \, \|\beta\|, \tag{8}$$
$$\varepsilon \sim k_\varepsilon \, \|\beta\|, \tag{9}$$
$$\eta \sim k_\eta \, \|\beta\|, \tag{10}$$
$$\theta_{14} \sim k_\theta \, \|\beta\|. \tag{11}$$

IV. TOPOLOGICAL WINDING AND INTEGER TIME

The chiral operator G_{C_3} generates defects labeled by an integer winding number:

$$v \in \mathbb{Z}.$$

This integer counts how many times the phase winds around the defect. In Spanish, the word *vez* denotes a discrete occurrence (once, twice, thrice), matching the role of v as an "integer time" counter. The visual string $v \in \mathbb{Z}$ reads naturally as "vez".

V. PHENOMENOLOGY

A. Neutrino sector

The 8/9 vs. 1/9 split predicts:

- flux suppression in high-energy neutrinos,
- small sterile mixing $\theta_{14} \sim \|\beta\|$,
- deviations in short-baseline experiments.

B. Anisotropy

The one-form β peaks along C_2, implying:

- directional anisotropy toward Sgr A*,
- possible correlations in IceCube/KM3NeT arrival directions.

C. Dark sector

The norm $\|\beta\|$ sets:

- dark tau mass,
- dark photon mass,
- kinetic mixing,
- WEP-violating effects.

VI. DISCUSSION

The model organizes neutrino and dark-sector structure through a unified geometric mechanism. The one-form β is the directional backbone, encoding holon displacement, anisotropy, and topological winding. The integer $v \in \mathbb{Z}$ plays the role of discrete "integer time" (*vez*), linking topology and language in a natural way.

VII. CONCLUSION

We have constructed a geometric toy model in which:

- a three-node lattice and holon displacement generate an 8/9 vs. 1/9 split,
- a Randers one-form β controls dark-sector masses and mixing,
- topological winding $v \in \mathbb{Z}$ acts as an integer time counter,
- anisotropy toward Sgr A* arises naturally.

The framework is speculative but yields concrete, testable signatures.

NOTE ADDED (JUNE 2026)

The integer winding number $v \in \mathbb{Z}$ functions as a discrete time counter. In Spanish, *vez* denotes a discrete occurrence (once, twice, thrice), matching the physical meaning of v. The visual string $v \in \mathbb{Z}$ reads as "vez", providing a linguistic echo of the topological structure.